Facility	Actual Average Daily Flow, AADF (MGD)	Actual TN (mg/l)	Actual TP (mg/l)	Facility Assumptions
Conrad	0.32	7	0.15	Extended aeration without chemical P precipitation. Optimized for $LOT_{7.0TN}$.
Chinook	0.11	2.9	1.84	Oxidation ditch, optimized $LOT_{3.0TN}$; no P removal.
Hinsdale	0.028	13	1.06	Extended aeration package plant. Incomplete nitrification/denitrification; no P removal.
Manhattan	0.15	8.7	0.6	Fixed film system with nitrification/denitrification; unknown P removal.
Colstrip	0.195	unk	unk	Oxidation ditch, unknown performance.
East Helena	0.307	10.6	0.53	Activated sludge plant. Pretty good nitrification, little denitrification. Good P removal.
Stevensville	0.344	14.8	2.835	Oxidation ditch, with nitrification but limited nutrient removal. Planning for a BNR upgrade.

[1] ADF = average daily flow; DF = design flow

Facility	Design Flow (MGD)	Average Flow (MGD)	Actual TN (mg/l)	TN per RPA/WQBEL AML (mg/l)	Actual TP (mg/l)	TP per RPA/WQBEL AML (mg/l)
Conrad	0.5	0.32	7	N/A	0.15	N/A
Chinook	0.502	0.11	2.9	3.45	1.84	0.16
Hinsdale	0.03	0.028	13	None needed	1.06	None needed
Manhattan	0.37	0.15	8.6	0.3	0.6	0.05
Colstrip	0.6	0.195	Unk	N/A	Unk	N/A
East Helena	0.434	0.307	10.6	N/A	0.53	N/A
Stevensville	0.344	0.344	14.8	1.13	2.84	0.4

$LOT_{7.0TN}$ upgrade	$LOT_{3.0TN}$ upgrade	$LOT_{0.5TP}$ upgrade	$LOT_{0.1TP}$ upgrade	$LOT_{0.05TP}$ upgrade
N/A, currently meeting LOT	Retrofit with anoxic zone to convert to MLE	N/A, currently meeting LOT	Optimize chemical precipitation and solids removal	High dosage chemical precipitation and advanced solids removal
N/A, currently meeting LOT	N/A, currently meeting LOT	Retrofit with EBPR	Chemical precipitation and tertiary filtration	High dosage chemical precipitation and advanced solids removal
N/A, no RPA/WQBELs needed	N/A, no RPA/WQBELs needed	N/A, no RPA/WQBELs needed	N/A, no RPA/WQBELs needed	N/A, no RPA/WQBELs needed
Optimization to meet LOT	Retrofit with denitrification filters	N/A, currently meeting LOT	Chemical precipitation and tertiary filtration	High dosage chemical precipitation and advanced solids removal
Optimization to meet LOT	Retrofit with anoxic zone to convert to MLE	Retrofit with EBPR	Chemical precipitation and tertiary filtration	High dosage chemical precipitation and advanced solids removal
Optimization to meet LOT	Retrofit with denitrification filters	N/A, currently meeting LOT	Chemical precipitation and tertiary filtration	High dosage chemical precipitation and advanced solids removal
N/A, assume new BNR plant can meet LOT	Retrofit new plant with denitrification filters	N/A, assume new BNR plant can meet LOT	Chemical precipitation and tertiary filtration	N/A, LOT is below RPA/WQBEL

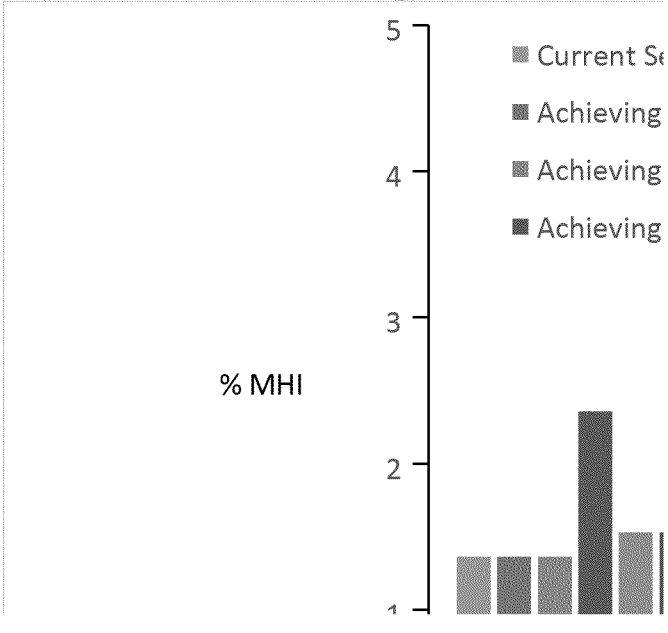
Facility	Treatment Objective	Capital Cost	O&M Cost	Annualized Costs[1]
Conrad	$LOT_{3.0TN}$	$597,456	$111,239	$159,155
Conrad	$LOT_{0.1TP}$	--	$900	$900
Conrad	$LOT_{0.05TP}$	$5,065,310	$550,007	$956,245
Chinook	$LOT_{0.5TP}$	$1,707,779	$157,725	$294,689
Chinook	$LOT_{0.1TP}$	$1,683,999	$361,476	$496,533
Chinook	$LOT_{0.05TP}$	$5,083,709	$552,013	$959,726
Manhattan	$LOT_{7.0TN}$	$9,100	--	$700
Manhattan	$LOT_{3.0TN}$	$889,701	$110,112	$181,466
Manhattan	$LOT_{0.1TP}$	$1,374,554	$278,988	$389,227
Manhattan	$LOT_{0.05TP}$	$3,856,995	$418,101	$727,432
Colstrip	$LOT_{7.0TN}$	$14,800	--	$1,200
Colstrip	$LOT_{3.0TN}$	$709,506	$129,239	$186,141
Colstrip	$LOT_{0.5TP}$	$2,041,170	$188,516	$352,218
Colstrip	$LOT_{0.1TP}$	$1,896,196	$420,565	$572,640
Colstrip	$LOT_{0.05TP}$	$5,979,542	$649,556	$1,129,116
East Helena	$LOT_{7.0TN}$	$10,700	--	$900
East Helena	$LOT_{3.0N}$	$1,009,000	$123,700	$204,600
East Helena	$LOT_{0.1TP}$	$3,220,910	$183,380	$441,697
East Helena	$LOT_{0.05TP}$	$4,455,106	$483,442	$840,741
Stevensville	$LOT_{3.0TN}$	$841,000	$104,600	$172,000
Stevensville	$LOT_{0.1TP}$	$1,309,493	$262,253	$367,274

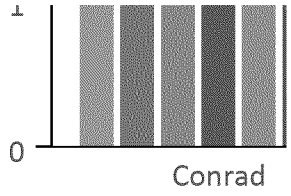
1. Annualized costs are based on a discount rate, *i*, of 5%, and term, *n*, of 20 years.

Alternative	References
Anoxic zone addition	Foess 1998
Optimize with higher alum dosing	Keplinger (2003), Scuras (2016)
Alum + Tertiary Clarifier + Filter + UF	Jiang 2005, EPA 2015b
EBPR	Washington 2011
Chem P + Filtration	Jiang 2005
Alum + Tertiary Clarifier + Filter + UF	Jiang 2005, EPA 2015b
Optimization	EPA (2015), Water Planet (2016)
Post-treatment denitrification filter	Foess 1998
Chem P + Filtration	Jiang 2005
Alum + Tertiary Clarifier + Filter + UF	Jiang 2005, EPA 2015b
Optimization	EPA (2015), Water Planet (2016)
Anoxic zone addition	Foess 1998
EBPR	Washington 2011
Chem P + Filtration	Jiang 2005
Alum + Tertiary Clarifier + Filter + UF	Jiang 2005, EPA 2015b
Optimization	EPA (2015), Water Planet (2016)
Post-treatment denitrification filter	Foess 1998
Alum addition and filters	Washington 2011
Alum + Tertiary Clarifier + Filter + UF	Jiang 2005, EPA 2015b
Post-denite filter	Foess 1998
Chem P + Filtration	Jiang 2005

Facility	Actual TN (mg/l)	Actual TP (mg/l)
Conrad	7	0.15
Chinook	2.9	1.84
Hinsdale	13	1.06
Manhattan	8.7	0.6
Colstrip	unk	unk
East Helena	10.6	0.53
Stevensville	14.8	2.835

Facility Assumptions	LOT 7.0 TN upgrade
Extended aeration without chemical P precipitation. Optimized for LOT7.0TN.	N/A, currently meeting LOT
Oxidation ditch, optimized LOT3.0TN; no P removal.	N/A, currently meeting LOT
Extended aeration package plant. Incomplete nitrification/denitrification; no P removal.	N/A, no RPA/WQBELs needed
Fixed film system with nitrification/denitrification; unknown P removal.	Optimization to meet LOT
Oxidation ditch, unknown performance.	Optimization to meet LOT
Activated sludge plant. Pretty good nitrification, little denitrification. Good P removal.	Optimization to meet LOT
Oxidation ditch, with nitrification but limited nutrient removal. Planning for a BNR upgrade.	N/A, assume new BNR plant can meet LOT

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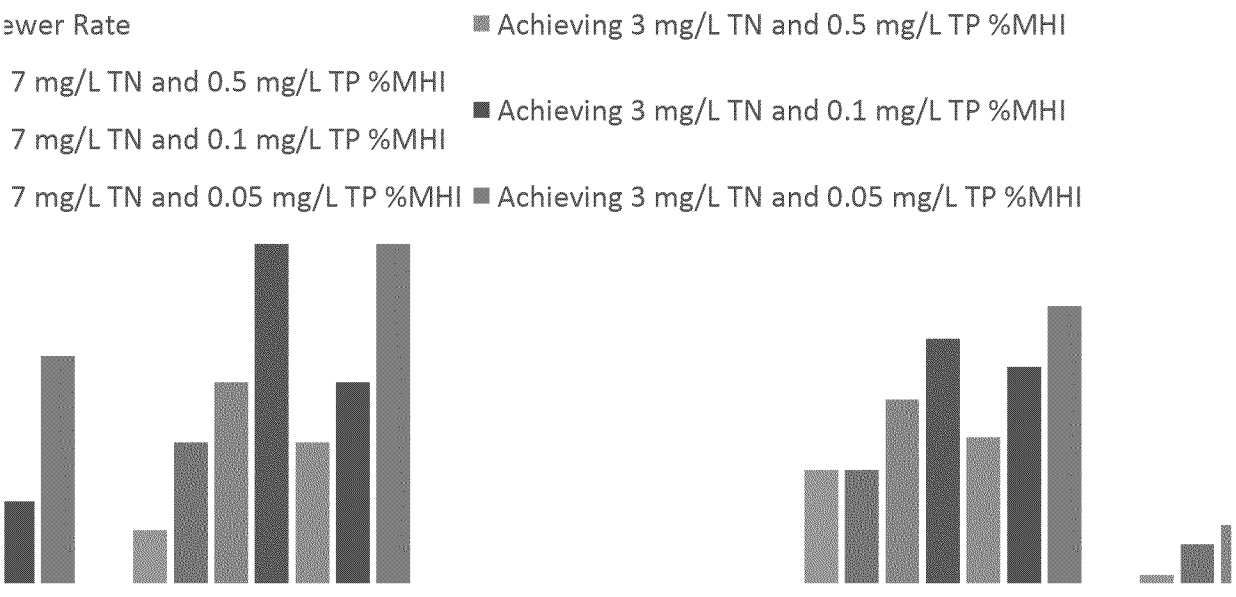
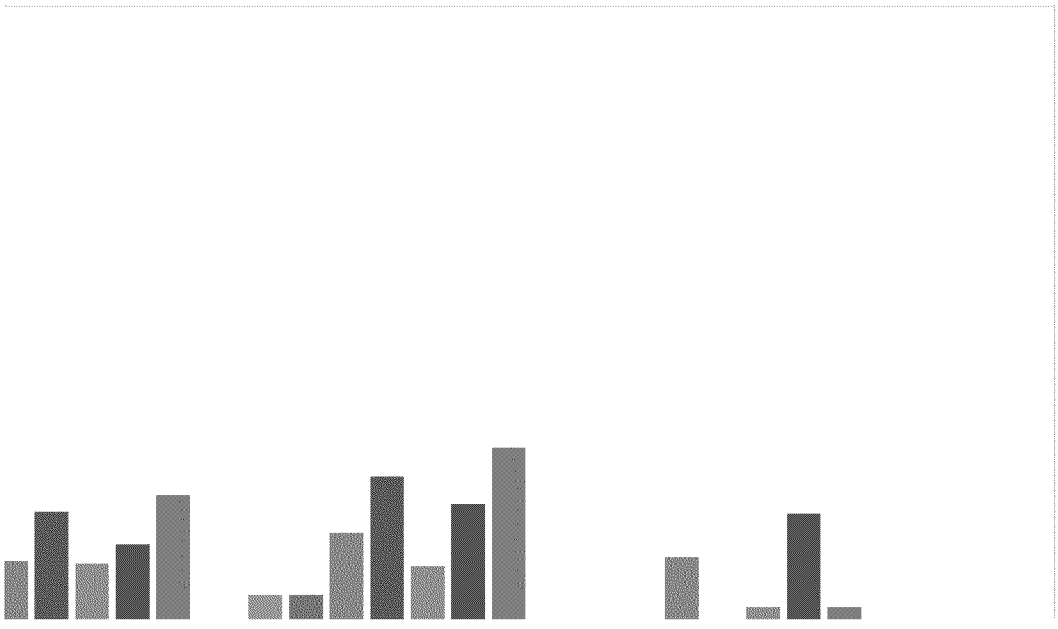
Conrad

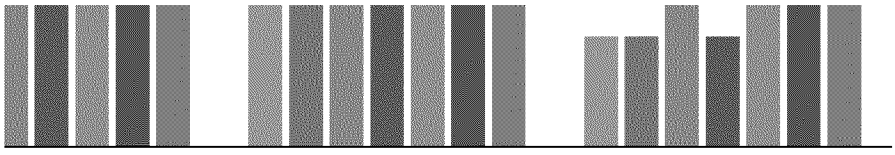
LOT 7.0 TN upgrade cost/year	LOT 3.0 TN upgrade	LOT 3.0 TN upgrade cost/year	LOT P upgrade to 0.5 mg/L TP	LOT P upgrade to 0.5 mg/L TP cost/year
$0.00	Retrofit with anoxic zone to convert to MLE	$159,155	N/A, currently meeting LOT	$0.00
$0.00	N/A, currently meeting LOT	$0.00	Retrofit with EBPR	$294,689
$0.00	N/A, no RPA/WQBELs needed	$0.00	N/A, no RPA/WQBELs needed	$0.00
$700	Retrofit with denitrification filters	$181,466	N/A, currently meeting LOT	$0.00
$1,200	Retrofit with anoxic zone to convert to MLE	$186,141	Retrofit with EBPR	$352,218
$900	Retrofit with denitrification filters	$204,600	N/A, currently meeting LOT	$0.00
$0.00	Retrofit new plant with denitrification filters	$172,000	N/A, assume new BNR plant can meet LOT	$0.00




Chinook
Hinsdale
Manhattan

LOT P upgrage to 0.1 mg/L TP	LOT P upgrade to 0.1 mg/L TP cost/year	LOT P upgrade to 0.05 mg/L TP	LOT P upgrade to 0.05 mg/L TP cost/year	MHI
Optimize chemical precipitation and solids removal	$900	High dosage chemical precipitation and advanced solids removal	$956,245	$38,372
Chemical precipitation and tertiary filtration	$496,533	High dosage chemical precipitation and advanced solids removal	$959,726	$37,656
N/A, no RPA/WQBELs needed	$0.00	N/A, no RPA/WQBELs needed	$0.00	$43,542
Chemical precipitation and tertiary filtration	$389,227	High dosage chemical precipitation and advanced solids removal	$727,432	$54,091
Chemical precipitation and tertiary filtration	$572,640	High dosage chemical precipitation and advanced solids removal	$1,129,116	$74,905
Chemical precipitation and tertiary filtration	$441,697	High dosage chemical precipitation and advanced solids removal	$840,741	$49,091
Chemical precipitation and tertiary filtration	$367,274	N/A, LOT is below RPA/WQBEL	$0.00	$29,819




Colstrip
East Helena
Stevensville

Old current sewer bill/year	Old current % MHI	Number of households	Current sewer bill/year	Current Sewer Rate	Achieving 7 mg/L TN and 0.5 mg/L TP %MHI	Achieving 7 mg/L TN and 0.1 mg/L TP %MHI
		2,501	$522	1.36	1.36	1.36
		1,300	$501	1.33	1.93	2.35
		250		#VALUE! NA	NA	
		1,500	$943	1.74	1.75	2.22
		2,214	$766	1.02	1.24	1.37
		2,114	$557	1.13	1.14	1.56
		1,920	$224	0.75	0.75	1.39

Achieving 7 mg/L TN and 0.05 mg/L TP %MHI	Achieving 3 mg/L TN and 0.5 mg/L TP %MHI	Achieving 3 mg/L TN and 0.1 mg/L TP %MHI	Achieving 3 mg/L TN and 0.05 mg/L TP %MHI
2.36	1.53	1.53	2.52
3.29	1.93	2.35	3.29
NA	NA	NA	NA
2.64	1.97	2.45	2.86
1.70	1.35	1.48	1.82
1.95	1.33	1.76	2.14
0.75	1.05	1.69	1.05